E-Commerce Sales Analysis

In this project, we delve into the sales and profit data of an e-commerce business to uncover valuable insights. The analysis includes identifying key trends, evaluating performance across categories, and assessing the sales-to-profit efficiency. These insights aim to assist decision-making and optimize business strategies for improved profitability and customer satisfaction.

1. **Calculate monthly sales and identify the months with the highest and lowest sales.**
2. **Analyze sales by product categories and determine the highest and lowest performing categories.**
3. **Perform sales analysis based on sub-categories.**
4. **Calculate monthly profit and identify the month with the highest profit.**
5. **Analyze profit by product categories and sub-categories.**
6. **Examine sales and profit by customer segment.**
7. **Evaluate the sales-to-profit ratio.**

import all importat libraries

[32]:
```
import pandas as pd #pandas (pd): Data manipulation ke liye use hota hai, jaise CSV file load karna aur process karna.
import plotly.express as px #plotly.express (px): Data visualization library jo easy aur quick plots banata hai.
import plotly.graph_objects as go #plotly.graph_objects (go): Advanced and customizable graphs banane ke liye
import plotly.io as pio   #plotly.io (pio): Graph templates ko customize karne ke liye
import plotly.colors as colors
pio.templates.default = "plotly_white"  #pio.templates.default = "plotly_white": Default theme white rakha gaya hai graphs ke liye
```

[2]:
```
data = pd.read_csv("Sample - Superstore.csv", encoding='latin-1')
#encoding='latin-1': Special characters ko properly read karne ke liye encoding use hui hai
data.head()
```

[2]:

	Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	...	Postal Code	Region	Product ID	Category	Sub-Category	Produ Nam
0	1	CA-2016-152156	11/8/2016	11/11/2016	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-BO-10001798	Furniture	Bookcases	Bus Somers Collectic Bookcas
1	2	CA-2016-152156	11/8/2016	11/11/2016	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-CH-10000454	Furniture	Chairs	Hon Delux Fabr Upholstere Stackir Chairs,
2	3	CA-2016-138688	6/12/2016	6/16/2016	Second Class	DV-13045	Darrin Van Huff	Corporate	United States	Los Angeles	...	90036	West	OFF-LA-10000240	Office Supplies	Labels	Sel Adhesiv Addre Labels f Typewrite b
3	4	US-2015-108966	10/11/2015	10/18/2015	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	33311	South	FUR-TA-10000577	Furniture	Tables	Bretfor CR45(Series Sli Rectangul Tab
4	5	US-2015-108966	10/11/2015	10/18/2015	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	33311	South	OFF-ST-10000760	Office Supplies	Storage	Eldon Fo 'N Roll Ca Syste

5 rows × 21 columns

Let's start by looking at the descriptive statistics of the dataset

[3]:
```
data.describe()
```

[3]:

	Row ID	Postal Code	Sales	Quantity	Discount	Profit
count	9994.000000	9994.000000	9994.000000	9994.000000	9994.000000	9994.000000
mean	4997.500000	55190.379428	229.858001	3.789574	0.156203	28.656896
std	2885.163629	32063.693350	623.245101	2.225110	0.206452	234.260108
min	1.000000	1040.000000	0.444000	1.000000	0.000000	-6599.978000
25%	2499.250000	23223.000000	17.280000	2.000000	0.000000	1.728750
50%	4997.500000	56430.500000	54.490000	3.000000	0.200000	8.666500
75%	7495.750000	90008.000000	209.940000	5.000000	0.200000	29.364000
max	9994.000000	99301.000000	22638.480000	14.000000	0.800000	8399.976000

[4]:
```
data.head()
```

[4]:

	Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	...	Postal Code	Region	Product ID	Category	Sub-Category	Prod Na
0	1	CA-2016-152156	11/8/2016	11/11/2016	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-BO-10001798	Furniture	Bookcases	B Some Collect Bookc
1	2	CA-2016-152156	11/8/2016	11/11/2016	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-CH-10000454	Furniture	Chairs	Hon Del Fa Upholste Stack Chai
2	3	CA-2016-138688	6/12/2016	6/16/2016	Second Class	DV-13045	Darrin Van Huff	Corporate	United States	Los Angeles	...	90036	West	OFF-LA-10000240	Office Supplies	Labels	S Adhe Addr Labels Typewri
3	4	US-2015-108966	10/11/2015	10/18/2015	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	33311	South	FUR-TA-10000577	Furniture	Tables	Bretf CR4 Series S Rectang Ta
4	5	US-2015-108966	10/11/2015	10/18/2015	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	33311	South	OFF-ST-10000760	Office Supplies	Storage	Eldon F 'N Roll C Syst

5 rows × 21 columns

[5]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9994 entries, 0 to 9993
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Row ID         9994 non-null   int64
 1   Order ID       9994 non-null   object
 2   Order Date     9994 non-null   object
 3   Ship Date      9994 non-null   object
 4   Ship Mode      9994 non-null   object
 5   Customer ID    9994 non-null   object
 6   Customer Name  9994 non-null   object
 7   Segment        9994 non-null   object
 8   Country        9994 non-null   object
 9   City           9994 non-null   object
 10  State          9994 non-null   object
 11  Postal Code    9994 non-null   int64
 12  Region         9994 non-null   object
 13  Product ID     9994 non-null   object
 14  Category       9994 non-null   object
 15  Sub-Category   9994 non-null   object
 16  Product Name   9994 non-null   object
 17  Sales          9994 non-null   float64
 18  Quantity       9994 non-null   int64
 19  Discount       9994 non-null   float64
 20  Profit         9994 non-null   float64
dtypes: float64(3), int64(3), object(15)
memory usage: 1.6+ MB
```

Convertin date Coulmns

[6]:
```
data['Order Date'] = pd.to_datetime(data['Order Date'])
data['Ship Date'] = pd.to_datetime(data['Ship Date'])
#Date Conversion: Order Date aur Ship Date columns ko datetime format me convert kiya gaya hai for date-based analysis.
```

Adding new Data-Based Columns

[7]:
```
data['Order Month'] = data['Order Date'].dt.month
data['Order Year'] = data['Order Date'].dt.year
data['Order Day of Week'] = data['Order Date'].dt.dayofweek

#Order Month: Order date se month extract karte hain.
#Order Year: Order date se year extract hota hai.
#Order Day of Week: Week ka day (0 for Monday, 6 for Sunday) extract kiya gaya hai.
```

[8]:
```
data.head()
```

[8]:

	Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	...	Category	Sub-Category	Product Name	Sales	Quantity	Discount
0	1	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	Furniture	Bookcases	Bush Somerset Collection Bookcase	261.9600	2	0.00
1	2	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	Furniture	Chairs	Hon Deluxe Fabric Upholstered Stacking Chairs,...	731.9400	3	0.00
2	3	CA-2016-138688	2016-06-12	2016-06-16	Second Class	DV-13045	Darrin Van Huff	Corporate	United States	Los Angeles	...	Office Supplies	Labels	Self-Adhesive Address Labels for Typewriters b...	14.6200	2	0.00
3	4	US-2015-108966	2015-10-11	2015-10-18	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	Furniture	Tables	Bretford CR4500 Series Slim Rectangular Table	957.5775	5	0.45
4	5	US-2015-108966	2015-10-11	2015-10-18	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	Office Supplies	Storage	Eldon Fold 'N Roll Cart System	22.3680	2	0.20

5 rows × 24 columns

Monthly Sales Analysis

[29]:
```
sales_by_month = data.groupby('Order Month')['Sales'].sum().reset_index()
sales_by_month
```

[29]:

	Order Month	Sales
0	1	94924.8356
1	2	59751.2514
2	3	205005.4888
3	4	137762.1286
4	5	155028.8117
5	6	152718.6793
6	7	147238.0970
7	8	159044.0630
8	9	307649.9457
9	10	200322.9847
10	11	352461.0710
11	12	325293.5035

[30]:
```
fig = px.line(sales_by_month,
              x='Order Month',
              y='Sales',
              title='Monthly Sales Analysis')
fig.show()
```

Sales Analysis by Category

28]:
```
sales_by_category = data.groupby('Category')['Sales'].sum().reset_index()
sales_by_category
```

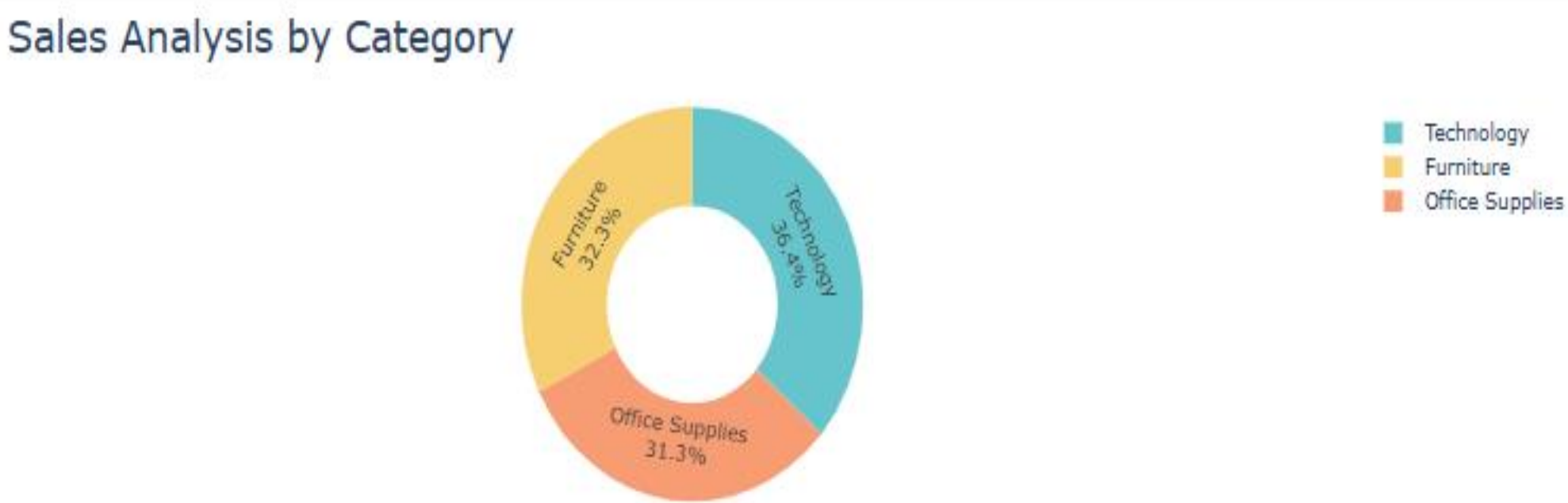
28]:

	Category	Sales
0	Furniture	741999.7953
1	Office Supplies	719047.0320
2	Technology	836154.0330

*[10]:
```
fig = px.pie(sales_by_category,
             values='Sales',
             names='Category',
             hole=0.5,
             color_discrete_sequence=px.colors.qualitative.Pastel)

fig.update_traces(textposition='inside', textinfo='percent+label')
fig.update_layout(title_text='Sales Analysis by Category', title_font=dict(size=24))

fig.show()
```



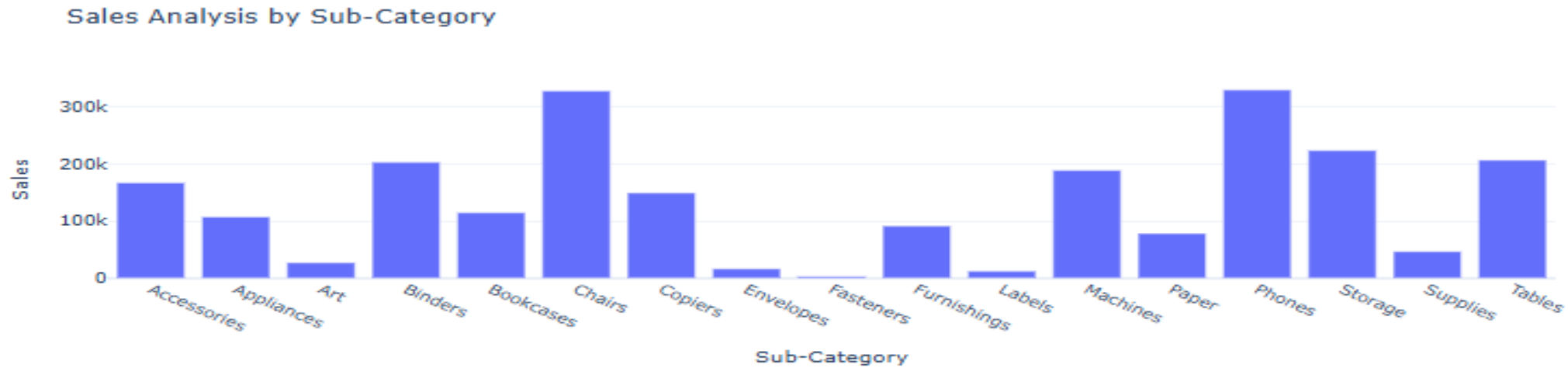
Sales Analysis by Sub-Category

[22]:
```
sales_by_subcategory = data.groupby('Sub-Category')['Sales'].sum().reset_index()
sales_by_subcategory
```

[22]:

	Sub-Category	Sales
0	Accessories	167380.3180
1	Appliances	107532.1610
2	Art	27118.7920
3	Binders	203412.7330
4	Bookcases	114879.9963
5	Chairs	328449.1030
6	Copiers	149528.0300
7	Envelopes	16476.4020
8	Fasteners	3024.2800
9	Furnishings	91705.1640
10	Labels	12486.3120
11	Machines	189238.6310
12	Paper	78479.2060
13	Phones	330007.0540
14	Storage	223843.6080
15	Supplies	46673.5380
16	Tables	206965.5320

[27]:
```
fig = px.bar(sales_by_subcategory,
             x='Sub-Category',
             y='Sales',
             title='Sales Analysis by Sub-Category')
fig.show()
```

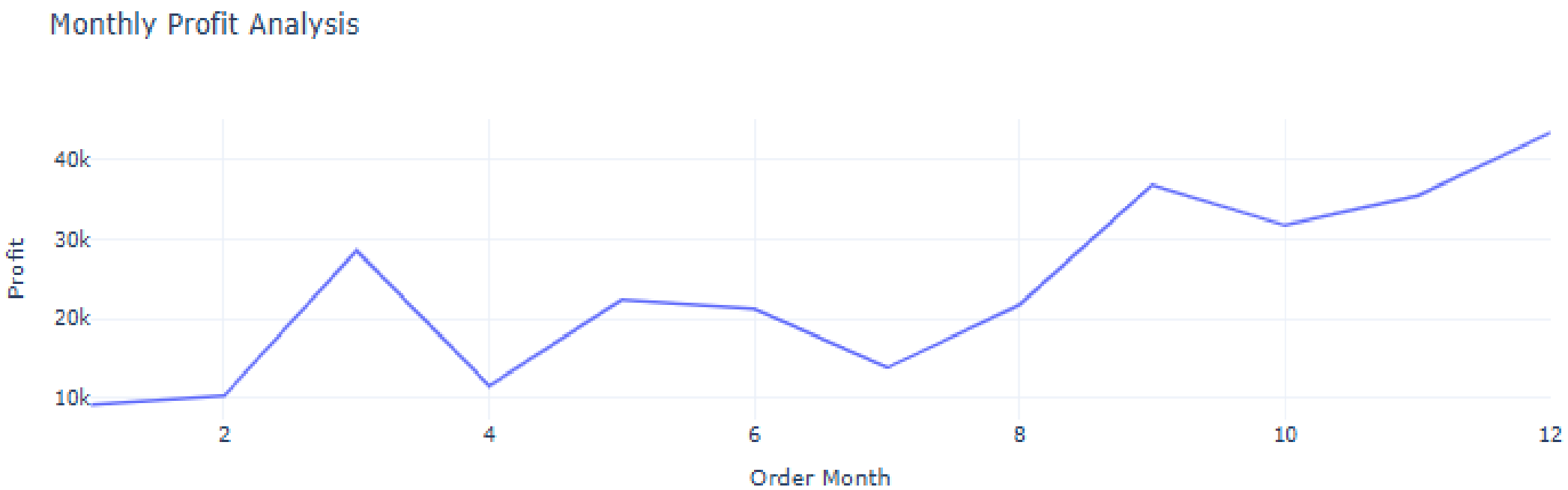


Monthly Profit Analysis

```
profit_by_month = data.groupby('Order Month')['Profit'].sum().reset_index()
profit_by_month
```

	Order Month	Profit
0	1	9134.4461
1	2	10294.6107
2	3	28594.6872
3	4	11587.4363
4	5	22411.3078
5	6	21285.7954
6	7	13832.6648
7	8	21776.9384
8	9	36857.4753
9	10	31784.0413
10	11	35468.4265
11	12	43369.1919

[26]:
```
fig = px.line(profit_by_month,
              x='Order Month',
              y='Profit',
              title='Monthly Profit Analysis')
fig.show()
```



Profit Analysis by Category

17]:
```
profit_by_category = data.groupby('Category')['Profit'].sum().reset_index()
profit_by_category
```

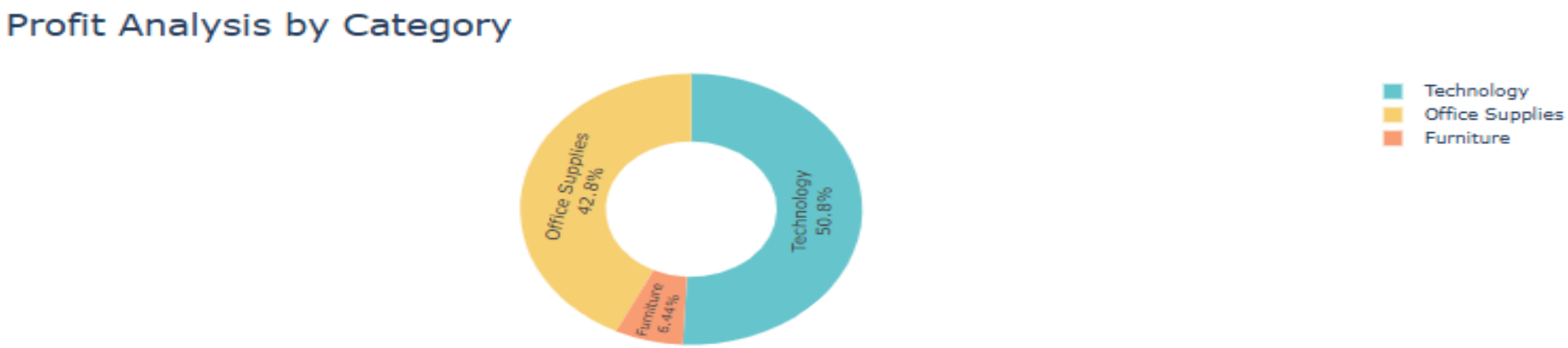
17]:

	Category	Profit
0	Furniture	18451.2728
1	Office Supplies	122490.8008
2	Technology	145454.9481

18]:
```
fig = px.pie(profit_by_category,
             values='Profit',
             names='Category',
             hole=0.5,
             color_discrete_sequence=px.colors.qualitative.Pastel)

fig.update_traces(textposition='inside', textinfo='percent+label')
fig.update_layout(title_text='Profit Analysis by Category', title_font=dict(size=24))

fig.show()
```



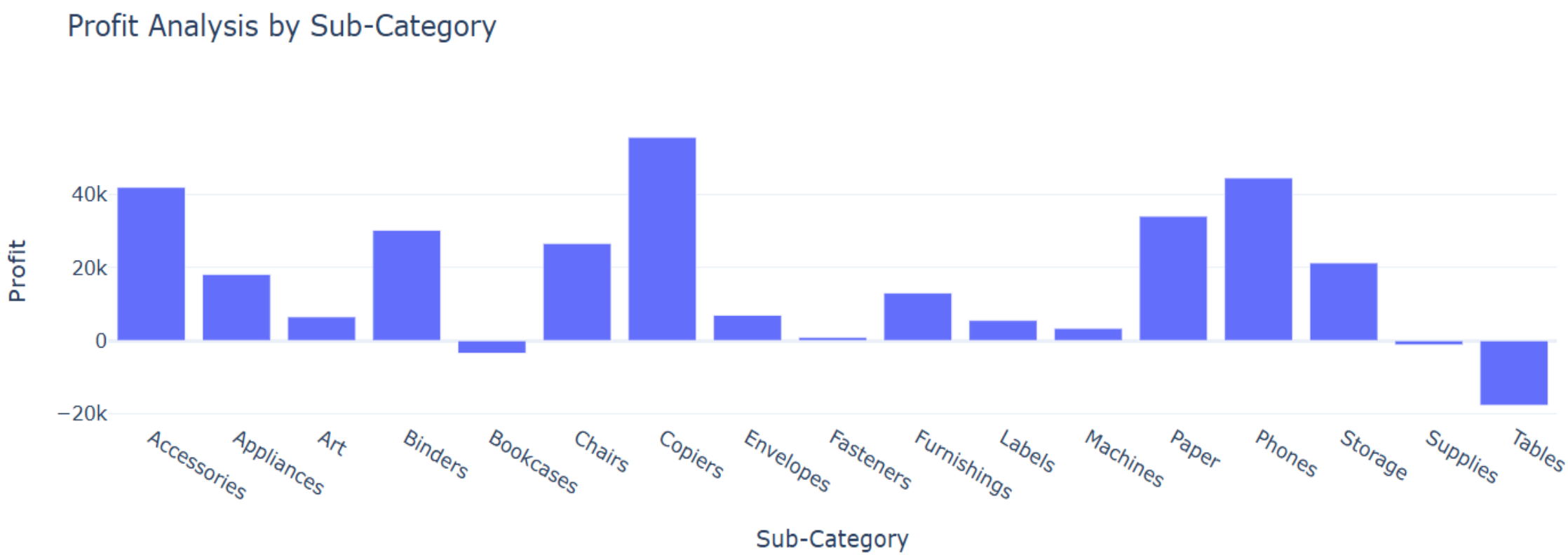
Profit Analysis by Sub-Category

[24]:
```
profit_by_subcategory = data.groupby('Sub-Category')['Profit'].sum().reset_index()
profit_by_subcategory
```

[24]:

	Sub-Category	Profit
0	Accessories	41936.6357
1	Appliances	18138.0054
2	Art	6527.7870
3	Binders	30221.7633
4	Bookcases	-3472.5560
5	Chairs	26590.1663
6	Copiers	55617.8249
7	Envelopes	6964.1767
8	Fasteners	949.5182
9	Furnishings	13059.1436
10	Labels	5546.2540
11	Machines	3384.7569
12	Paper	34053.5693
13	Phones	44515.7306
14	Storage	21278.8264
15	Supplies	-1189.0995
16	Tables	-17725.4811

[25]:
```
fig = px.bar(profit_by_subcategory, x='Sub-Category',
             y='Profit',
             title='Profit Analysis by Sub-Category')
fig.show()
```



Sales and Profit Analysis by Customer Segment

[31]:
```
sales_profit_by_segment = data.groupby('Segment').agg({'Sales': 'sum', 'Profit': 'sum'}).reset_index()
sales_profit_by_segment
```

[31]:

	Segment	Sales	Profit
0	Consumer	1.161401e+06	134119.2092
1	Corporate	7.061464e+05	91979.1340
2	Home Office	4.296531e+05	60298.6785

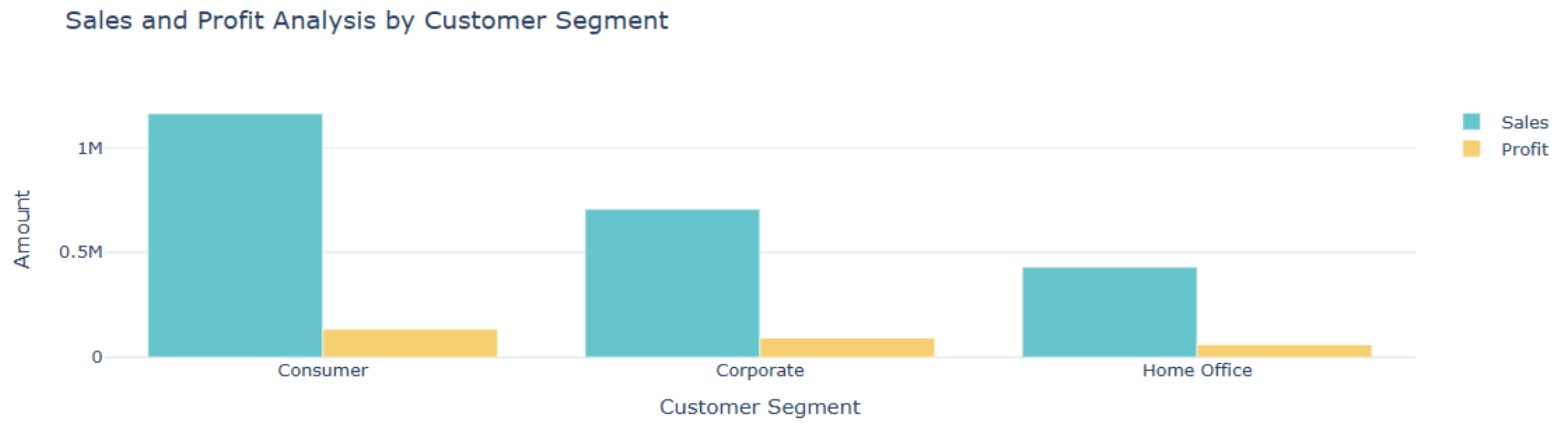
•[15]:
```
color_palette = colors.qualitative.Pastel

fig = go.Figure()
fig.add_trace(go.Bar(x=sales_profit_by_segment['Segment'],
                     y=sales_profit_by_segment['Sales'],
                     name='Sales',
                     marker_color=color_palette[0]))

fig.add_trace(go.Bar(x=sales_profit_by_segment['Segment'],
                     y=sales_profit_by_segment['Profit'],
                     name='Profit',
                     marker_color=color_palette[1]))

fig.update_layout(title='Sales and Profit Analysis by Customer Segment',
                  xaxis_title='Customer Segment', yaxis_title='Amount')

fig.show()
```



analyse sales-to-profit ratio

[16]:
```
sales_profit_by_segment = data.groupby('Segment').agg({'Sales': 'sum', 'Profit': 'sum'}).reset_index()
sales_profit_by_segment['Sales_to_Profit_Ratio'] = sales_profit_by_segment['Sales'] / sales_profit_by_segment['Profit']
print(sales_profit_by_segment[['Segment', 'Sales_to_Profit_Ratio']])
```

```
       Segment  Sales_to_Profit_Ratio
0     Consumer               8.659471
1    Corporate               7.677245
2  Home Office               7.125416
```